ENGINEERING DESIGN FILE

Project File Number ARA-729-97

Project/Task WAG-5 OU 5-12

Subtask Tank ARA-729 Evaluation

Title: ARA-729 Radiological Data Evaluation

Summary: This summary briefly defines the problem or activity to be addressed in the EDF, gives a summary of the activities performed in addressing the problem and states the conclusions, recommendations, or results arrived at from this task.

Auxiliary Reactor Area (ARA) Tank 729 was sampled in July 1997. This EDF addresses the radiological contents of the tank. Results of the sampling indicate the waste contains 78 nCi/g TRU, 24 mg of fissionable material, and a total activity of 2.4 Ci. This data was compared to sample results from 1994 and indicated a general lower activity. Both sampling campaigns should be reevaluated to better establish the validity of their respective results or additional sampling and analysis may be necessary.

Distribution (complete package): D. Y. Azevedo MS 3922, T. S. Bohn MS 4138, A. D. Coveleskie MS 4138, W. C. Craft MS 4138, C. Hiaring MS 3953, J. A. Jones MS 4138, F. L. Webber MS 3953

Distribution (summary package only):

Author	Dept.	Reviewed	Date	Approved	Date
A. D. Coveleskie	Radiological Controls	T. S. Bohn	11-17-97	C. Hiaring	11-24-97
		LMITCO Review N/A	Date	LMITCO Approval N/A	Date

See Management Control Procedure (MCP) 6 for instructions on use of this form.

Tank Description - The ARA-729 tank is located in Auxiliary Reactor Area I (ARA-I). It is made of stainless steel with a 1,000-gallon capacity and is buried five feet below the ground surface. The tank received liquid waste from ARA-626, which contained two hot cells, service areas, decontamination room, sink and floor drains, and the Hot Metalography Area.

Radiological Characterization - In July of 1997 the contents of ARA-729 were sampled. Three samples each were analyzed from the liquid and sludge. The analysis was conducted at McDermitt Laboratories. Since the sludge activity was reported on a per gram basis, a density of 1.18g/ml was used for conversion to milliliters. During the sampling, the volume of the liquid and sludge was estimated to be 278.5 gal. (1.05 E +6 ml) and 43 gal. (1.62 E +5 ml) respectively. The liquid level was noted to be approximately 8 inches higher than in June 1994, when the tank was last sampled. However, this estimate is based on a visual inspection only. The cause of the increase was assumed to be due to infiltration of water from rain and melting snow.

Analytical results were evaluated and shown in the attached tables. Also, these results were compared to the June 1994 sample results. A summary of the tank activity, for uranium and activation and fission products, is shown in Table 1. The liquid and sludge concentration is an average of the three samples taken from each phase. Based on the waste volume, the estimated activity is approximately 2.38 Ci with over 97% contained in the sludge.

Table 2 lists the quantity of fissionable material in the tank. Based on activity concentrations, the estimated amount is 23.6 mg.

Table 3 lists the transuranic nuclides and their respective concentrations. The total concentration is estimated to be 78.2 nCi/g in the tank, which would classify the material as Alpha Contaminated LLW (i.e. >10 nCi/g but < 100 nCi/g.

Tables 4 and 5 contain the June 1994 activity (EDF Serial # ARA-001). When a comparison was made, the July 1997 sample results were generally lower. Over all tank activity is approximately one half of that estimated in 1994. The largest contributors to this reduction are from Sr-90, fissionable material, and TRU. The 1994 data indicated the Sr-90 to be higher by a factor of 15 and the fissionable material and TRU to be higher by a factor of 10.

Conclusions/Recommendations – Differences in sample concentration and tank activity from 1994 and 1997 could be influenced by several factors. Such factors would be additional liquid and sampling device, technique, and location. Other sources of variation would include the number and kinds of analytes requested as well as analytical methods.

The amount of fissionable material should not present a criticality concern even if the quantity were a factor of ten higher.

TRU concentrations present a concern. The 1994 concentration was estimated at 900 nCi/g compared with 78 nCi/g in 1997. Additionally, Sr-90 contributed to almost half of the total tank activity in 1994. In 1997 the contribution is approximately 4%.

In order to determine an adequate characterization for ARA Tank 729, both previous sampling analysis and techniques should be evaluated to determine the validity of their respective results. An alternative to this recommendation would be to resample the tank for subsequent analysis.

References

1. Engineering Design File, Serial # ARA-001, A. D. Coveleskie, 8-14-95

Table 1 (1997 Activity)

Radionuclide	Liquid Concentration (pCi/ml)	Total Liquid Activity (Ci)	Sludge Concentration (pCi/ml)	Total Sludge Activity (Ci)	Total Tank Activity (Ci)
H-3	1.92 E +2	3.06 E -5	-	-	3.09 E -4
Co-60	1.74 E +1	1.83 E -5	2.39 E +5	3.87 E -2	3.87 E -2
Zn-65	-	-	6.49 E +3	1.05 E -3	1.05 E -3
Sr-90	1.68E+2	1.76 E -4	6.60 E +5	1.07 E -1	1.07 E -1
Ag-110m	-	-	3.65 E +3	5.91 E -4	5.91 E -4
Cs-134	2.05 E +2	2.15 E -4	3.64 E +4	5.96 E -3	6.17 E -3
Cs-137	5.92 E +4	6.22 E -2	1.33 E +7	2.15 E 0	2.21 E 0
Eu-152	-	-	2.54 E +4	4.11 E -3	4.11 E -3
Eu-154	-	-	6.87 E +3	1.11 E -3	1.11 E -3
U-234	7.64 E -1	8.07 E -7	4.18 E +4	6.77 E -3	6.77 E -3
U-238	1.56 E -2	1.64 E -8	1.89 E +1	3.06 E -6	3.06 E -6
Total	6.02 E +4	6.29 E -2	1.43 E +7	2.31 E 0	2.37 E 0

Table 2 (1997 Fissionable Material)

Radionuclide	Total Liquid Activity (Ci)	Total Sludge Activity (Ci)	Total Tank Activity (Ci)	Specific Activity (Ci/g)	Total Tank Quantity (g)
Pu-238	7.97 E -7	4.29 E -3	4.29 E -3	1.71 E +1	2.51 E -2
Pu-239	1.63 E -6	4.39 E -3	4.39 E -3	6.21 E -2	7.07 E -2
U-235	1.64 E -9	-	1.64 E -9	2.16 E -6	7.59 E -4
Am-241	1.85 E -6	6.25 E -3	6.25 E -3	3.43 E 0	1.82 E -3
Total	4.28 E -6	1.49 E -2	1.49 E -2	-	2.36 E -2

Table 3 (1997 TRU Concentrations)

Radionuclide	Liquid Concentration (nCi/g)	Sludge Concentration (nCi/g)	Total Tank Concentration (nCi/g)
Pu-238	7.59 E -4	2.25 E +1	2.25 E +1
Pu-239/240	1.55 E -3	2.30 E +1	2.30 E +1
Am241	1.76 E -3	3.27 E +1	3.27 E +1
Total	4.07 E -3	7.82 E +1	7.82 E +1

Table 4 (1994 Activity)

Radionuclide	Liquid Concentration (pCi/ml)	[1] Total Liquid Activity (Ci)	[2] Sludge Concentration (pCi/ml)	Total Sludge Activity (Ci)	Total Tank Activity (Ci)
Cs-134	1.04 E +3	2.14 E -4	7.18 E +4	1.16 E -2	1.18 E -2
Cs-137	1.34 E +5	2.76 E -2	1.18 E +7	1.91 E 0	1.94 E 0
Co-60	1.76 E +2	3.63 E -5	4.77 E +5	7.73 E -2	7.73 E -2
Eu-152	-	-	4.26 E +4	6.90 E -3	6.90 E -3
Eu-154	-	-	1.50 E +4	2.43 E -3	2.43 E -3
Sr-90	2.17 E +3	4.47 E -4	1.10 E +7	1.78 E 0	1.78 E 0
[3]Am-241	3.99 E +1	8.22 E -6	2.84 E +5	4.60 E -2	4.60 E -2
[3]Cm-244	-	-	4.96 E +4	8.03 E -3	8.03 E -3
[3]Pu-238	1.50 E +1	3.09 E -6	3.78 E +5	6.12 E -2	6.12 E -2
[3]Pu-239/240	6.34 E +1	1.31 E -5	3.56 E +5	5.77 E -2	5.77 E -2
Th-228	2.82 E 0	5.81 E -7	1.76 E +5	2.85 E -2	2.85 E -2
Th-230	-	-	1.02 E +4	1.65 E -3	1.65 E -3
U-234	-	-	5.26 E +4	8.52 E -3	8.52 E -3
[3]U-235	-	-	1.14 E +3	1.85 E –4	1.85 E -4
U-238	-	-	2.87 E +3	4.65 E -4	4.65 E -4
TOTAL	-	2.83 E -2	-	4.00 E 0	4.24 E 0

1. Total activity is based on a liquid volume of 54.5 gallons (2.06 E +5 ml).
2. Concentration is based on a sludge density of 1.18 g/ml.
3. Fissionable material.

Table 5 (1994 Concentrations)

Radionuclide	Liquid (nCi/g)	Sludge (nCi/g)
Am-241	3.99 E -2	2.41 E +2
Cm-244	-	4.20 E +1
Pu-238	1.50 E -2	3.20 E +2
Pu-239/240	6.34 E -2	3.02 E +2
Total	1.18 E -1	9.05 E +2